Table 9.4-1. Numbers of Samples Chemically Analyzed During the Portland Harbor BERA.

Location	Sediment	Sediment Toxicity Tests	Fish and Invertebrate Tissue	Bird Eggs	Surface Water	Transition Zone Water
Study Area (RM 1.9 – RM 11.8)	1,469	269	315	5	313	192
Downstream reach (RM 0 – RM 1.9)	21	0	5	0	0	0
Multnomah Channel	7	0	0	0	0	0
Downtown reach (RM 11.8 – RM 15.3)	17	2	6	0	0	0
Upstream (RM 15.3 – RM 28.4)	22	22	18	5	0	0

Notes:
BERA - baseline ecological risk assessment
RM - river mile

Table 9.6-1. Number of COPCs Evaluated in the BERA.

Medium or Diet	No. of COPCs	No. of Chemicals without Screening-Level TRVs
Sediment	67	106
Invertebrate tissue	18	23
Fish tissue	16	8
Fish dietary dose	9	11
Bird dietary dose	23	19
Mammal dietary dose	12	11
Bird egg tissue	5	0
Surface water	14	19
TZW	58	14

Notes:
BERA - baseline ecological risk assessment
COPC - contaminant of potential concern
TRV - toxicity reference value
TZW - transition zone water

Table 9.6-2. COPCs Forwarded to the BERA after Screening.

Receptor Group	Media Evaluated	Number of COPCs	COPCs
Benthic invertebrates, bivalves, decapods	Surface water, TZW, sediment, tissue	104	20 metals, 2 butyltins, 21 individual PAHs or PAH sums, 4 phthalates, 12 SVOCs, 6 phenols, 16 pesticide or pesticide sums, total PCBs, 2,3,7,8-TCDD (dioxin), 16 VOCs, 3 total TPH fractions, cyanide, perchlorate
Fish	Surface water, TZW, sediment, diet, tissue	74	19 metals, 4 butyltins, 17 individual PAHs or PAH sums, BEHP, 3 SVOCs, total PCBs, dioxin TEQ, total TEQ, 7 pesticide or pesticide sums, 18 VOCs, cyanide, perchlorate
Birds and mammals	Diet (birds and mammals), bird eggs	23 (birds) 12 (mammals)	11 metals, 3 individual PAHs or PAH sums, 2 phthalates, total PCBs, dioxin TEQ, PCB TEQ, total TEQ, 3 pesticide or pesticide sums
Aquatic plants, amphibians	Surface water, TZW	64	15 metals, monobutyltin, 16 individual PAHs, BEHP, 3 SVOCs, total PCBs, 6 pesticide or pesticide sums, 18 VOCs, gasoline-range hydrocarbons, cyanide, perchlorate

Notes:

BEHP - bis(2-ethylhexyl) phthalate
BERA - baseline ecological risk assessment
COPC - contaminant of potential concern
PAH - polycyclic aromatic hydrocarbon
PCB - polychlorinated biphenyl
SVOC - semivolatile organic compound
TCDD - tetrachlorodibenzo-p-dioxin
TEQ - toxic equivalent
TPH - total petroleum hydrocarbons
TZW - transition zone water
VOC - volatile organic compound

Table 9.10-1. Sediment Toxicity Test Results.

Test	Level 0 (No Toxicity)	Level 1 (Low Toxicity)	Level 2 (Moderate Toxicity)	Level 3 (Severe Toxicity)
Chironomus survival	210 of 256	12 of 256	9 of 256	25 of 256
Chironomus biomass	190 of 256	24 of 256	7 of 256	35 of 256
Hyalella survival	224 of 256	15 of 256	2 of 256	15 of 256
Hyalella biomass	143 of 256	47 of 256	42 of 256	24 of 256

Table 9.10-2. COPCs Posing Potentially Unacceptable Ecological Risks within the Portland Harbor Study Area.

Assessment Endpoint	Exposure Pathway	COPCs with HQ ≥ 1.0	Section of the BERA with Additional Details
Aquatic plants, amphibians	Surface water	Benzo(a)anthracene, benzo(a)pyrene, BEHP, naphthalene, total DDx, total PCBs,[a] zinc	Sections 9-1 (amphibians) and 10-1 (aquatic plants)
	TZW	1,2,4-trimethylbenzene, 1,2-dichlorobenzene, 2-methylnaphthalene, 4,4′-DDT, acenaphthene, anthracene, barium, benzo(a)anthracene, benzo(a)pyrene, cadmium, carbon disulfide, chlorobenzene, chloroethane, chloroform, copper, cyanide, ethylbenzene, fluorene, gasoline fraction (aliphatic) C4 – C6, gasoline fraction (aliphatic) C10 – C12, iron, isopropylbenzene, lead, magnesium, manganese, naphthalene, nickel, perchlorate, phenanthrene, potassium, sodium, toluene, total DDx, zinc	Sections 9-2 (amphibians) and 10-1 (aquatic plants)
Benthic invertebrates, bivalves, decapods	Sediment	2,4′-DDD, 2-methylnaphthalene, 4,4′-DDD, 4,4′-DDE, 4,4′-DDT, 4-methylphenol, acenaphthene, acenaphthylene, ammonia,[b] anthracene, Aroclor 1254,[c] arsenic,[c] benzo(a)anthracene, benzo(a)pyrene,[c] benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, benzyl alcohol, cadmium, carbazole, chlordane (cis and trans),[c] chromium, chrysene, cis-chlordane, copper, dibenzo(a,h)anthracene, dibenzofuran, dibutyl phthalate, dieldrin, diesel-range petroleum hydrocarbons, endrin, endrin ketone, fluoranthene, fluorene, gasoline-range hydrocarbons,[d] heptachlor epoxide,[c] indeno(1,2,3-cd)pyrene, lead, lindane (γ‑HCH),[c] mercury, naphthalene,[c] nickel,[c] phenanthrene, phenol, pyrene, residual-range hydrocarbons,[e] silver, sulfide,[b] sum DDD, sum DDE, sum DDT, total chlordane,[c] total DDx, total endosulfan, total HPAH, total LPAH, total PAH, total PCBs, TBT, zinc,[c] β-HCH, δ-HCH	Sections 6-2 and 6-3
	Surface water	4,4′-DDT,[a] benzo(a)anthracene, benzo(a)pyrene, BEHP, ethylbenzene, naphthalene, total DDx, total PCBs,[a] trichloroethene, zinc	Section 6-5

Table 9.10-2. COPCs Posing Potentially Unacceptable Ecological Risks within the Portland Harbor Study Area.

Assessment Endpoint	Exposure Pathway	COPCs with HQ ≥ 1.0	Section of the BERA with Additional Details
	TZW	1,1-Dichloroethene, 1,2,4-trimethylbenzene, 1,2-dichlorobenzene, 1,3,5‑trimethylbenzene, 1,4-dichlorobenzene, 2-methylnaphthalene, 4,4′-DDT, acenaphthene, anthracene, barium, benzene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, beryllium, cadmium, carbon disulfide, chlorobenzene, chloroethane, chloroform, chrysene, cis-1,2-dichloroethene, cobalt, copper, cyanide, dibenzo(a,h)anthracene, dibenzofuran, ethylbenzene, fluoranthene, fluorene, gasoline fraction (aliphatic) C4 – C6, gasoline fraction (aliphatic) C6 – C8, gasoline fraction (aliphatic) C10 – C12, gasoline fraction (aromatic) C8 – C10, indeno(1,2,3-cd)pyrene, iron, isopropylbenzene, lead, m,p-xylene, magnesium, manganese, naphthalene, nickel, o‑xylene, perchlorate, phenanthrene, potassium, pyrene, sodium, toluene, total DDx, total xylenes, trichloroethene, vanadium, zinc	Section 6-6
	Tissue	4,4′-DDD, arsenic, BEHP, copper, total DDx, total PCBs, TBT, zinc	Section 6-4

Table 9.10-2. COPCs Posing Potentially Unacceptable Ecological Risks within the Portland Harbor Study Area.

Assessment Endpoint	Exposure Pathway	COPCs with HQ ≥ 1.0	Section of the BERA with Additional Details
Fish	Surface water	4,4′-DDT,[a] benzo(a)anthracene, benzo(a)pyrene, BEHP, ethylbenzene, naphthalene, total DDx, total PCBs,[a] trichloroethene, zinc	Section 7-3
	TZW	1,1-Dichloroethene, 1,2,4-trimethylbenzene, 1,2-dichlorobenzene, 1,3,5‑trimethylbenzene, 1,4-dichlorobenzene, 2-methylnaphthalene, 4,4′-DDT, acenaphthene, anthracene, barium, benzene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, beryllium, cadmium, carbon disulfide, chlorobenzene, chloroethane, chloroform, chrysene, cis-1,2-dichloroethene, cobalt, copper, cyanide, dibenzo(a,h)anthracene, dibenzofuran, ethylbenzene, fluoranthene, fluorene, gasoline fraction (aliphatic) C4 – C6, gasoline fraction (aliphatic) C6 – C8, gasoline fraction (aliphatic) C10 – C12, gasoline fraction (aromatic) C8 – C10, indeno(1,2,3-cd)pyrene, iron, isopropylbenzene, lead, m,p-xylene, magnesium, manganese, naphthalene, nickel, o‑xylene, perchlorate, phenanthrene, potassium, pyrene, sodium, toluene, total DDx, total xylenes, trichloroethene, vanadium, zinc	Section 7-4
	Fish tissue	Antimony, BEHP, copper, lead, total DDx, total PCBs	Section 7-1
	Diet	Cadmium, copper, mercury, TBT	Section 7-2
Birds	Diet	Aldrin, benzo(a)pyrene, copper, dibutyl phthalate, lead, sum DDE, total DDx, total dioxin/furan TEQ, total PCBs, total PCB TEQ, total TEQ	Section 8-1
	Bird egg tissue	Total dioxin/furan TEQ, total PCBs, total PCB TEQ, total TEQ	Section 8-2

Table 9.10-2. COPCs Posing Potentially Unacceptable Ecological Risks within the Portland Harbor Study Area.

Assessment Endpoint	Exposure Pathway	COPCs with HQ ≥ 1.0	Section of the BERA with Additional Details
Mammals	Diet	Aluminum, lead, total dioxin/furan TEQ, total PCBs, total PCB TEQ, total TEQ	Section 8-1

Notes:

[a] Identified as a COPC (HQ ≥ 1.0) when the AWQC TRV was adopted; not identified as a COPC (HQ < 1.0) when the alternative TRV was adopted. These chemicals are not included in the total counts of COPCs with potentially unacceptable ecological risk unless they were identified as a COPC for another LOE.

[b] Ammonia and sulfide in bulk sediment exceeded SLs but are not included in the total counts of COPCs with potentially unacceptable ecological risk.

[c] Identified as a COPC based on concentrations that exceeded the sediment PEC and/or PEL [BERA Section 6.3]; chemical was not identified as a COPC based on the FPM or LRM predicted toxicity LOE. These chemicals are not included in the total counts of COPCs with potentially unacceptable ecological risk unless they were identified as a COPC for another LOE (e.g., arsenic is identified as a COPC with potentially unacceptable risk for benthic invertebrates based on the tissue LOE and is, therefore, included in the total count of COPCs).

[d] Identified as a COPC based on concentrations that exceeded the TPH SQG (i.e., the chemical was not identified as a COPC for any other benthic sediment evaluation).

[e] Identified as a COPC based on concentrations that exceeded the TPH SQG; chemical was not included in the COPC counts if identified as a COPC based only on the TPH SQG exceedence.

AWQC - ambient water quality criteria
BEHP - bis(2-ethylhexyl) phthalate
COPC - chemical of potential concern
DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethylene
DDT - dichlorodiphenyltrichloroethane
FPM - floating percentile model
HCH - hexachlorocyclohexane
HPAH - high-molecular-weight polycyclic aromatic hydrocarbon
HQ - hazard quotient
LOE - line of evidence
LPAH - low-molecular-weight polycyclic aromatic hydrocarbon
LRM - logistic regression model
PCB - polychlorinated biphenyl
PEC - probable effects concentration
PEL - probable effects level
SL - screening level
SQG - sediment quality guideline
TBT - tributyltin
TEQ - toxic equivalent
total DDx - sum of all six DDT isomers (2,4′-DDD, 4,4′-DDD, 2,4′-DDE, 4,4′-DDE, 2,4′-DDT and 4,4′-DDT)
TPH - total petroleum hydrocarbons
TRV - toxicity reference value
TZW - transition zone water

Table 9.10-3. BERA LOEs for which No Potentially Unacceptable Ecological Risks Are Identified.

Assessment Endpoint	Measurement Endpoint	Line of Evidence
Survival, growth, reproduction of benthic invertebrates	Benthic invertebrate tissue data compared to tissue TRVs	Field-collected epibenthic macroinvertebrate tissue concentration (from Hester-Dendy samplers) relative to tissue TRVs
Survival, growth, reproduction of bivalves	Sediment toxicity testing to empirically assess adverse effects	*Corbicula fluminea* survival in 28‑day bioaccumulation test
Survival, growth, reproduction of omnivorous fish	Concentrations in surface water compared with water TRVs	
Survival and growth of detritivorous fish	Concentrations in surface water compared with water TRVs	

Notes:
BERA - baseline ecological risk assessment
LOE - line of evidence
TRV - toxicity reference value

Table 9.11-1. Chemicals Identified as Most Likely to be Contaminants of Ecological Significance.

Contaminants of Primary Ecological Significance	
PCBs	Dioxins and furans
PAHs	DDT and its metabolites
Additional Contaminants of Ecological Significance	
Total chlordanes	Mercury
Lead	Cadmium
Copper	BEHP
Zinc	Dieldrin
Lindane (γ-HCH)	Cyanide
Tributyltin	Ethylbenzene
Perchlorate	$C_{10} - C_{12}$ TPH
Manganese	Vanadium

Notes:
BEHP – bis(2-ethylhexyl) phthalate
PAH - polycyclic aromatic hydrocarbon
PCB - polychlorinated biphenyl